

ABSTRACT

Eurasian Heat Waves: Mechanisms and Predictability

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This study uses the NASA MERRA reanalysis and GEOS 5 model simulations to examine the causes of Eurasian heat waves including the recent extreme events that occurred in Europe during 2003 and in Russia during 2010. The focus is on the warm season and the part of the Eurasian continent that extends north of about 40°N, or roughly to the north of the mean upper tropospheric jet stream.

The results show that such extreme events are an amplification of natural patterns of atmospheric variability that develop over the Eurasian continent as a result of internal atmospheric forcing. The amplification occurs when the wave occasionally becomes locked in place for several weeks to months resulting in extreme heat and drying with the location depending on the phase of the upper atmospheric wave. An ensemble of very long GEOS-5 model simulations (spanning the 20th century) forced with observed SST and greenhouse gases show that the model is capable of generating very similar heat waves, and that they have become more intense in the last thirty years as a result of the overall warming of the Asian continent. Sensitivity experiments with perturbed initial conditions indicate that these events have limited predictability.

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